DOCUMENT RESUME

ED 174 450 SE 028 514

TITLE	Biomedical Social Science, Unit V: Perception, Learning and Intellectual Growth. Instructor's Manual. Revised Version, 1976.
INSTITUTION	Biomedical Interdisciplinary Curriculum Project, Berkeley, Calif.
SPONS AGENCY	National Science Foundation, Washington, D.C.
PUB DATE	76
NOTE	47p.; For related documents, see SE 027 978-999 and SE 028 510-516; Not available in hard copy due to copyright restrictions
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Cognitive Processes; Health; *Health Education; *Learning; Learning Characteristics; Learning Processes; Learning Theories; Lesson Plans; *Moral Development; Perceptual Development; Science Education; *Secondary Education; *Visual Perception

ABSTRACT

This collection contains lessons in 4 subjects related to learning: (1) visual perception; (2) learning; (3) cognitive growth; and (4) moral development. Activities dominate each lesson and students are expected to do some experimentation outside the classroom. Each of the 20 lessons presents: (1) a synopsis; (2) objectives; (3) necessary supplies; (4) assignment to be completed by students before the lesson; and (5) suggested teaching procedures. A supplementary lesson is also offered following the main lesson sequence. (Author/RE)

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SCIENCE CURRICULUM PROJECT

BIOLOGICAL SCIENCE

UNIT V
PERCEPTION, LEARNING AND INTELLECTUAL GROWTH

INSTRUCTOR'S MANUAL

SE 028 514

BIOMEDICAL SOCIAL SCIENCE

UNIT V

PERCEPTION, LEARNING AND INTELLECTUAL GROWTH

INSTRUCTOR'S MANUAL

REVISED VERSION, 1976

THE BIOMEDICAL INTERDISCIPLINARY CURRICULUM PROJECT

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PREFATORY NOTE TO THE INSTRUCTOR:

Although this is not a lengthy unit, it does contain four related parts: visual perception, learning, cognitive growth, and moral development. The opening topic, visual perception, relates to Unit IV of Science and Mathematics, and much is known about it. Much is also known about learning. The last two topics are still the subjects of considerable debate; they are included because they give students the opportunity to consider some factors that may assist them in communicating with others and in understanding why people act as they do.

Activities dominate this unit, and students are expected to do some experimentation outside the classroom. Although this will heighten student interest, it will make your task more demanding. For many lessons, you will need to make advance preparations to insure the success of the activities. The Advance Preparations section of the Instructor's Manual is especially important for this unit.

A brief summary of the unit follows.

Visual Perception (Lessons 1-3): These lessons begin with a consideration of optical illusions. Students encounter some of these in class on the first day, and they read of more in the Student Text. Discussions move from physical explanations of illusions to cultural and social factors that affect perception. An optional experiment allows students to see how individuals' reports of a perception can affect the reports of others. A reading suggests ways in which culture may affect perception.

Learning (Lessons 4-9): In these lessons students experiment on themselves. There are many technical terms, all of which are defined in the Student Text. It is especially important that you read all six lessons before beginning this part of the unit, because most of the experiments require advance preparation on your part.

Because the experiments in this first part of the unit are conducted on Biomedical students, the class must not know in advance about the learning principles being tested. These materials are developed with the belief that students should come to discover, on their own, the principles contained in the lessons. Although many of these will be known to you, it is important that you allow students to face each lesson without prior knowledge.

Cognitive Development (Lessons 10-17): These lessons deal with the theories of cognitive development formulated by Jean Piaget. After learning something about three simple intellectual tasks, students administer the same tasks to young children. They then look critically at the resulting data to determine whether differences among age groups emerge. There is a field trip in Lesson 12, probably to a local elementary school. You may need time from the Biomedical Science or Biomedical Mathematics class or from both classes; be certain to prepare for this trip long in advance. Because your students will need to experiment on young children, you'll also need to secure a "laboratory" for this purpose. This may not be easy to do, so you should begin this selection as soon as possible. When you read these lessons you'll also realize that you will need to secure some equipment not normally found in social studies classrooms.

Moral Development (Lessons 18-20): These three lessons are based upon the theory of cognitive moral development formulated by Lawrence Kohlberg. Although this theory has received widespread attention recently, it remains highly controversial. For this reason we have not given it extensive treatment and we have encouraged students to approach it critically. Students respond to some moral dilemmas, analyze their responses, and discuss the theory of cognitive moral development. They may want to test this theory by asking others to respond to moral dilemmas. A discussion of the entire unit concludes the final lesson.

Supplementary Lesson: This lesson, to be taught shortly after Lesson 20 of Science Unit IV, considers some common shortcomings of experimental design as they manifest themselves in studies on the effects of drug use.

ADVANCE PREPARATIONS REQUIRED

Several lessons in this unit will require advance preparations on your part in addition to the normal reading of the instructor's and student's materials. The preparations required are described briefly below. More information appears in the Advance Preparations section of each lesson cited, with the exception of lessons 1 and 5.

Lessons 1 and 5: Experiments conducted in class during these lessons require some materials, which are listed either under Supplies (in the case of expendable materials) or Equipment on the first page of each lesson.

Lesson 6: Advance preparations for an experiment to be conducted during this lesson include making cue cards, preparing instruction sheets and deciding on the experimental procedure to be used.

Lesson 7: An experiment to be conducted during this lesson requires that two strings be suspended from the ceiling in your classroom or another nearby place. Instructions on how to rig the strings are in the Advance Preparations section of the lesson.

Lesson 8: During this lesson students discuss inductive reasoning (specifically hypothesis formation) and deductive reasoning (specifically hypothesis testing), which are topics common to the natural and the social sciences. The lesson suggests that you and the Science instructor consider designing an interdisciplinary lesson on the subject.

Lessons 11 through 14: In this sequence students prepare for and conduct an experiment on elementary-school students. Advance preparations required include assembling the necessary equipment for the experiment and arranging for a field trip to an elementary school. Note: It may be possible to combine this field trip with a Science field trip that occurs at about the same time. You should discuss this possibility with the Science instructor well in advance.

Lesson 17: This lesson suggests that you might invite a guest speaker to talk to the class about the difficulties of communicating with young children about health problems and treatment.

A NOTE ON FORMAT:

In this Instructor's Manual you will find some notations in square brackets. For example, the following notation appears on the first page of the first lesson:

[Read "Can You Trust Your Own Eyes?"]

"Can You Trust Your Own Eyes" is the first reading in the Student Text. (All materials listed in square brackets appear in the Student Text unless otherwise noted.) The notations in square brackets have been included to help you find your way through the student materials with a minimum of confusion when you first encounter these lessons. When you are reading a lesson for the first time, begin at the beginning of the lesson plan in this book. When you come to a notation in square brackets, read the indicated materials. Then resume reading the lesson plan where you left off.

By using these notations in this way you will encounter all student materials in a context such that the student materials help you make sense of the lesson plans, and the lesson plans help you to make sense of the student materials. In addition, you will encounter the student materials in approximately the order in which the students will encounter them as you teach the lessons.

LESSON 1: INTRODUCTION TO PERCEPTION

SYNOPSIS:

This lesson serves as an introduction to the unit. Students view optical illusions and speculate on why they sometimes "see" what isn't really there.

OBJECTIVES:

The student will:

- participate in one or more activities that illustrate the phenomenon of "optical illusion."
- speculate on possible reasons for inaccurate perception of physical objects.

SUPPLIES:

4x6 or 5x8 index cards (one per student; pieces of unlined paper of about the same size will also work)

STUDENT TEXT:

Can You Trust Your Own Eyes? (homework assignment)

SUGGESTED TEACHING PROCEDURES:

[Read "Can You Trust Your Own Eyes?"]

A. Experiencing Optical Illusions: Present some optical illusions to students. You may know of several that can be represented on the board. Several examples are presented in the Student Text reading, and students may know of others. Two that are easily drawn on the board are illustrated below and on the next page.

In Figure 1, the vertical line will appear to be longer when angled lines move up from point A and down from point B, and shorter when angled lines move down from point A and up from point B. In Figure 2, the plane formed by corners A, B, C, and D can be seen to be the forward face of the cube, but after a few moments the viewer may suddenly see plane EFGH as the forward face. The first example is clearly one of illusion; line AB is exactly the same length in both drawings. The second example is not really an illusion; it illustrates the multistability of the figure. That is, there is only one drawing, but it is possible to "see" two different things in the drawing. One cannot see both cubes simultaneously, although the practiced eye (and brain) can cause plane ABCD to move back and forth rapidly.

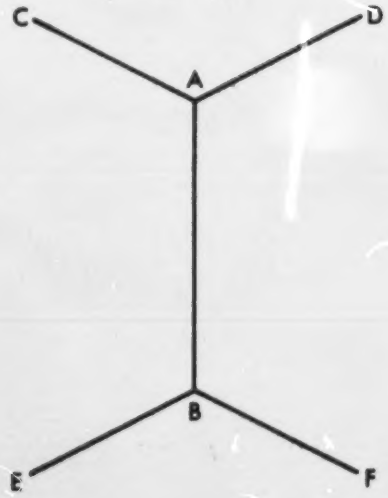


FIGURE 1a

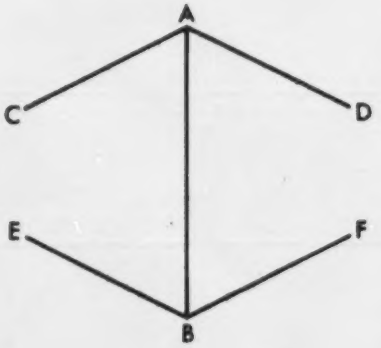


FIGURE 1b

When drawing these figures on the board, note that each has only two different lengths of line. In the first, line AB is the same length in both figures; so are lines AC, AD, BE and BF. In the cube figure, all lines are the same length as either AB or AE. It will help make the lesson more dramatic if these figures are placed on the board before you begin the lesson. Allow time for students to examine the figures and to indicate which vertical line is longer in Figure 1 and to try to get the plane ABCD to appear to move in Figure 2.

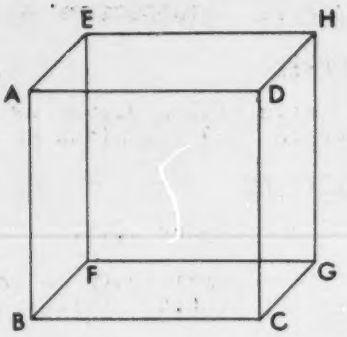


FIGURE 2

Another illusion can be introduced, although it is more difficult to perceive. Distribute index cards to students and instruct them to fold their cards lengthwise in half; if there are lines on one side of the card, that side should be the inside of the folded card. The folded cards should be placed on desks in front of students so that a rooflike structure is seen from one end. Now three illusions are possible.

First, the student can stand over the card and, with one eye closed, look down directly at the "peak of the roof." The card will then reverse and appear as an open book. That is, the peak will reverse and appear to be at the bottom, rather than the top, of the lengthwise card. This effect, also illustrated in the Student Text, is another example of multistability.

A more difficult illusion to demonstrate may be seen by closing one eye and viewing the card from one end, at an angle of about 45° upward from the ridge of the folded card (see Figure 3). The front of the folded card (the "empty" triangle) should be in view. A student who concentrates and is patient will usually find that, after a few seconds, the card will actually appear to stand up on end as if it were an open book.

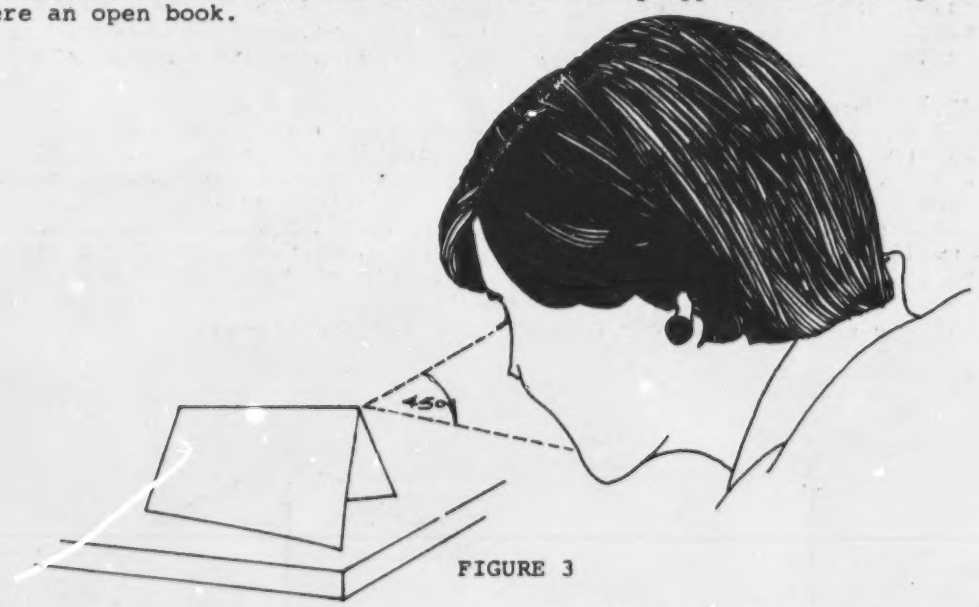


FIGURE 3

Some students may not be able to achieve this illusion. However, by standing the card on end, the student can see how the illusion ought to appear. This might help the student see the illusion.

Once a student masters this reversal, another illusion is possible. Again keeping one eye closed, and while the illusion of an upright card is in view, the student should move his head slowly back and forth. The card will appear to be rocking back and forth even though it is quite stationary. This dramatic effect is worth the time it will take for some students to achieve it.

B. Discussion of Optical Illusions: Although there are additional examples of optical illusions in the Student Text, you may want to delay distribution of the texts until the discussion is completed. In this way, students will be more inclined to speculate and less likely to look for the answers in their texts.

The discussion of optical illusions should begin with a specific discussion of what students have observed in class and end with a consideration of possible explanations for our sometimes "seeing" what isn't there. Although there are complex physiological explanations for some false perceptions (such as the view of the folded card rocking back and forth), other illusions are more easily explained. In short, what we see is affected by things we have seen before. The process of perception includes interpretive processes that occur in the brain. Students may be able to reach this conclusion. However, it is not important to force the discussion to this point. It is sufficient that students sense some doubt about their own perceptions, and be willing to suggest possible explanations for "seeing" what isn't there.

ASSIGNMENT:

Students should read "Can You Trust Your Own Eyes?" in the Student Text.

LESSON 2: SOME FACTORS AFFECTING PERCEPTION

SYNOPSIS:

A discussion of the homework reading is combined with further discussion of optical illusions. Students are asked to identify factors that may affect their perception.

OBJECTIVE:

The student will identify at least one factor that can affect perception and explain how the intervention occurs.

SUPPLIES:

Master: A Minority of One (Unit IV, Lesson 6; one per student, optional)

STUDENT TEXT:

Culture and Perception (homework assignment)

SUGGESTED TEACHING PROCEDURES:

This discussion should pick up where you left off during the previous lesson. Students will probably want to discuss optical illusions further. Some may not have seen the illusions in their texts, and some may not have been led to see the young girl before they saw the old woman. All this is good material for discussion.

If time allows, you may want to mention the use of projective tests in the analysis of mental disorders. If your school has a psychologist or counselor familiar with such tests, that person can be a useful resource for your class. The best-known projective tests are the Rorschach ink-blot test and the TAT (Thematic Apperception Test). In the former, patients tell what they see in each of several ink-blots. In the TAT, subjects create a story after viewing an ambiguous picture. By analyzing the way in which the patient has interpreted the visual stimuli, the trained interviewer is often able to detect personality characteristics that may otherwise not be evident.

At an appropriate point in the discussion, raise a question such as, "What affects your visual perception?" Students should easily realize from their Science course that the retinal image is an obvious factor. From their reading, they should also be able to understand that past visual experiences affect perception. There are other factors, and students can speculate on these. The reading assignment

suggested that culture could affect perception, and you can ask students to discuss the ways in which it does so. In addition to the influences of experience and culture, cues immediately associated with the act of perception may affect the interpretation of stimuli, as they probably did when students encountered the young girl/old woman drawing.

[Read the Master, "A Minority of One," from Unit IV.]

In the preceding unit students participated in an experiment in which peer behavior affected their own behavior (Unit IV, Lessons 5 and 6). These lessons could just as well have been included in this unit, for they also illustrate how social factors can affect perception. Therefore, you should ask students to recall that experiment and to indicate what it might tell them about perception. A review of the last paragraph of the reading "A Minority of One," which was distributed after that experiment, states that some subjects actually saw incorrectly. This should provide students with a clue as to the possible effects of social context upon perception. One can become so convinced of the error of his own perception that he sees what he expects to see, and not what is in front of him. In the case of the experiment from Unit IV, what subjects expected to see was what previously reporting peers stated (falsely) that they saw.

You and your class may be able to think of other examples of social factors affecting perception. The discussion should move toward a more general consideration of the effects a culture may have on its members, including effects upon perception. You may want to review some aspects of Unit II, especially lessons 2 - 9, which relate culture, personality, attitudes, behavior, perception and values.

ASSIGNMENT:

[Read "Culture and Perception."]

Students should read "Culture and Perception," in the Student Text.

LESSON 3: CULTURE AND PERCEPTION

SYNOPSIS:

The first part of the discussion is optional; it illustrates how the discussion of a visual stimulus can lead to the formation of a group norm regarding perception of the stimulus. The rest of the discussion is based upon the assignment, which describes some relationships between culture and perception.

OBJECTIVE:

The student will provide an example of how culturally acquired attitudes can affect perception.

SUGGESTED TEACHING PROCEDURES:

A. The Autokinetic Effect: This activity and discussion are optional; use either or both if you have time and want to provide an additional illustration of how social factors affect perception. You may want to take time to construct the necessary equipment to illustrate this effect, or students may want to perform the experiment on other students in the school.

All that is required is a shoe box that contains a light source such as a flashlight. The box should have a small hole on one side, and the box should be tightly sealed with opaque tape so that no light can escape except through the small hole. A completely darkened room is essential.

Subjects should be assembled in groups of three to six, and told that they will see a tiny point of light. When the room lights are off and the tiny point of light is on, the subjects are to pay close attention to the point of light. The experimenter should immediately begin asking individual subjects which way the light is

moving, and continue doing so until the subjects begin discussing the matter among themselves. After a short time (usually about fifteen minutes), subjects should be reporting generally similar answers. They should all be seeing the light move in approximately the same direction. In fact, of course, the light never moves.

If you do not take time to conduct this experiment, you may wish to tell students about it. A full description can be found in M. Sherif and C.W. Sherif, An Outline of Social Psychology, Harper & Co., New York, 1965. The autokinetic effect occurs when a subject concentrates on a point of light in an otherwise dark room. Without prodding, the subject will report that the light is moving around. In fact, the light source is completely stable. It appears to move because there is no stable background in relation to which a subject can judge its position. As the room is gradually made lighter, the effect diminishes and disappears.

Sherif and Sherif used this already validated phenomenon, the autokinetic effect, to test the effects of social factors on perception. They conducted the experiment with groups, rather than individual subjects, and asked subjects to report publicly what they saw. As the subjects took turns reporting, and then reporting again and again, their answers began to converge upon a common response. All subjects reported the light moving in the same general direction. In this way a group norm was formed. Group interaction affected the direction in which the point source of light was perceived to be moving.

By serving as subjects in the experiment (or having it described to them) students should be able to uncover the fact that a group norm is developing. This is additional information about social effects upon perception.

B. Discussion of the Assignment: The description of Allport and Postman's experiment and Hudson's work should provide ample material for students to discuss. Try to steer the discussion toward the idea that what we perceive is affected by what we have learned in the past. To the extent that our culture has determined what we have learned, it acts as a "pair of glasses" through which we perceive ourselves, each other and everything in our environment.

During this discussion (probably as a concluding topic) you should ask students how the effects of culture upon perception can be an important element in health-related occupations. Students may have several ideas about this. The Allport and Postman study illustrates how stereotypes (which are culturally acquired) affect our perception of others. Health workers may, for example, have stereotypical attitudes toward the elderly which will affect their perception of the physical, emotional and mental health of older patients. The same can be said for attitudes toward ethnic or minority groups. Does the black health worker make untested assumptions about white clients? If so, do these assumptions affect his perception of these clients' health problems? Does a patient's poor command of English and preference for some other language affect the nature of the health care he will receive? Questions such as these are important in relating these lessons to the concerns of your students, and you should allow as much time as is necessary for a profitable discussion.

ASSIGNMENT:

There is no assignment. However, students should be told that, since learning affects perception and perception affects learning, the next several lessons will be on learning. If you have time, it would be good to ask students to summarize what they now know about perception.

Note: this is an excellent time for you and your colleagues in Biomedical Science and Mathematics to develop an interdisciplinary evaluation of student learnings. For example, students might discuss the vision-screening activity (Science Unit IV, Lesson 35). In addition to sources of error discussed in the other Biomedical classes, what kinds of error could be introduced into the vision test by the fact that everyone involved--test subjects as well as test administrators--interprets visual and other stimuli? What might happen if a test subject had become convinced that his vision was poor, though he had no physical defects that would affect his vision? What might happen if a test administrator were under heavy peer pressure to find no vision problems? (Could he actually misperceive the subjects' responses--as subjects misperceived the lengths of lines in the "Minority of One" experiment?) How would students design the vision-screening process to prevent changes in the test results due to the effects of social factors on perception?

LESSON 4: SIMPLE PROBLEM-SOLVING

SYNOPSIS:

This lesson introduces the topic of learning. Half the students (the subjects) attempt to solve a simple paper-and-pencil problem, while the other half observe the problem-solving processes the subjects use. The class then discusses the processes.

OBJECTIVES:

The student will:

- through participation in a simple experiment, develop confidence in his ability to experiment on peers.
- describe at least two ways in which people can approach the problem used in the experiment.

SUPPLIES:

Master: Experiment I: Instructions for Experimenters (one per student for half the class).

SUGGESTED TEACHING PROCEDURES:

A. Problem-Solving Experiment:

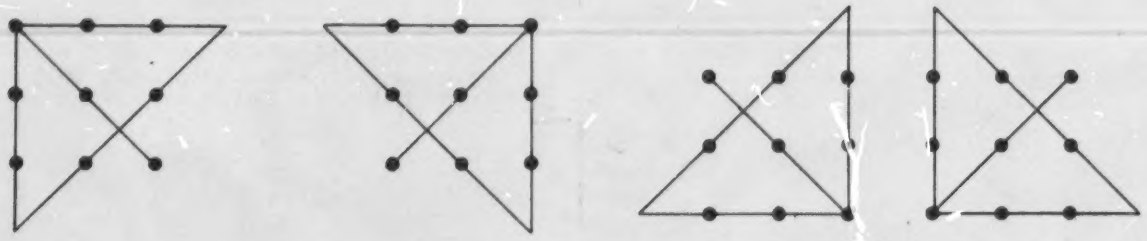
[Read the Master.]

Begin the class with the experiment. No introduction is necessary, except perhaps to tell students that they will be participating in a simple problem-solving test, the purpose of which will become clear in the discussion after the activity. Ask students to form pairs for the activity. (If you have an odd number of students add an observer to one pair.)

When students have paired off, tell them that one member of each pair will be the experimenter and the other the subject. The subject will be asked to attempt to solve a paper-and-pencil puzzle, and the experimenter will carefully observe and record what the subject does. Each pair may decide who will be the subject. When that has been accomplished, give each experimenter a copy of the "Instructions for Experimenters." The experimenters will need a few minutes to read their instructions; subjects will need to be patient. When experimenters are ready to begin, announce that the experimenters will explain the task and that subjects will have no more than twenty minutes to attempt a solution. Each subject must have several blank sheets of paper and a pencil or pen. Subjects may not talk while they are attempting the task. When the instructions are clear and every subject has paper and pencil, begin the experiment.

Note: Some subjects will solve the problem rather quickly, and others will be so frustrated as to be restless. You may be able to excuse some of these students from the room until the discussion begins; if not, the task of keeping them silent is important.

B. Discussion of the Experiment: When the twenty minutes have elapsed (earlier if everyone has been able to solve the problem) begin the discussion of the experiment. Let someone who was successful show the correct solution to the problem. The solution requires an extension of three lines beyond the "square" formed by the nine points. There are four ways of doing this, all of which are based on the same extension principle. (Note that you must begin at the apex of the triangle or the point outside the triangle.)



Open two areas for discussion:

1. What are the subjects' impressions of the experimenters? Did the latter explain the task carefully? Did they contaminate the results of the experiment by assisting or hindering the subjects? How did they feel about the way their experimenters behaved? (These questions are intended to produce some insights about the crucial role of the experimenter in an experiment. Some experimenters probably did not perform as they should, and for them this discussion can be important preparation for future experiments.)

2. What procedures did subjects use? Did any give up in frustration? Did some continue to make blind attempts? Did some stop and reflect on different approaches? Did some see the solution right off? How are these different responses explained? Did some subjects assume that they could not extend their lines beyond the "square" formed by the nine points or that their lines must be of equal length? Why do people make such assumptions? (These questions are designed to introduce the next few lessons, on learning and problem-solving. The central lesson to be learned from the present experiment is that different people may proceed in different ways when they encounter the same problem.)

If this discussion does not consume the full class period, you might ask the class to consider how these subjects would have reacted to a problem that was equally difficult but much more important--for example, one that meant their grade in the course.

ASSIGNMENT:

There is no assignment.

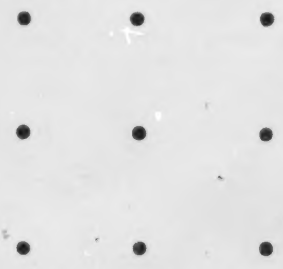
MASTER: EXPERIMENT I: INSTRUCTIONS FOR EXPERIMENTERS

You will administer an experiment to one subject. Your responsibilities will be to explain the task to the subject and to observe and remember what the subject does as he or she completes the task. You are not to answer any questions the subject might ask. Below are step-by-step instructions on how to administer the experiment.

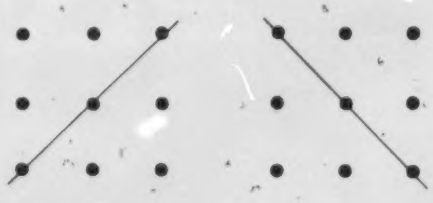
1. You and the subject should be seated at two desks facing each other, or in two chairs on opposite sides of a table. The subject will be working with pencil and paper. You should be able to see what the subject is doing, but the subject should not be able to see what other subjects are doing.

2. The subject will need a pencil and several sheets of paper.

3. When the subject has pencil and paper, take one sheet of paper and a pencil, and draw nine points on the sheet of paper, in the pattern shown to the right. The entire array of points should be square, and it should be about the size shown to the right.



To be sure you have drawn the points correctly, judge <u>by eye</u>--without drawing lines on the paper--whether a straight line drawn diagonally through the corner points will also pass through the center point, as shown below.



4. When you have drawn the array of points on the paper, hand the paper to the subject and give the following instructions.

> "Your task is to connect all these points, with four straight lines, without lifting the pencil from the paper and without retracing any line. Do not erase any lines. If you need to start over again, draw a new set of nine points, just like these, and begin again. You have twenty minutes to complete the task."

If the subject has questions, you may repeat the instructions once, but do not say anything else. Remember, <u>do not answer any questions</u>.

5. When you have given the instructions, note the time and tell the subject to begin. Write down what time it will be when twenty minutes have elapsed.

6. Watch what the subject does. Do not say <u>anything</u> to the subject unless you notice that the subject has drawn a new set of points incorrectly. In that case, say <u>only</u>, "You have drawn the points incorrectly. Look at the original points and try again." Do not say anything else; do not draw any more points for the subject or tell the subject how to draw the points.

7. Keep track of what the subject does. You may need to take notes; when the experiment is over you should be able to describe how the subject behaved. If the subject uses more than one sheet of paper, keep track of which sheet was used first, which second and so on. Do not take the used sheets away from the subject while the subject is still working on the task. If the subject talks or asks questions, make a mental note of what is said, but do not respond, except to say, "I'm sorry, but I can't answer any questions."

8. If the subject successfully completes the task, immediately collect all the sheets of paper that have been used. Remind the subject that others are still working on the task, and that the solution should not be revealed to them. (The solution requires some lines that extend beyond the edges of the imaginary square formed by the nine points. Do not reveal this information to the subject!)

9. If twenty minutes elapse before the subject completes the task, tell the subject that time is up, and immediately collect all the sheets of paper that have been used.

LESSON 5: ASSOCIATIVE LEARNING I: RESPONDENT CONDITIONING

SYNOPSIS:

During the first half of this lesson students conduct a simple experiment. The class is divided into two or three groups; each group includes a subject, an experimenter and observers. The subject, who is blindfolded, hears a sound and then has his foot tickled. Later he hears the sound alone, and the observers determine whether, as a result of his previous experience, he twitches his foot without being tickled. The second part of the lesson is a discussion of the results. The homework assignment is a reading on learning.

OBJECTIVES:

The student will:

- participate in a simple stimulus-response experiment.
- describe the results of the experiment in terms of the principle of stimulus-response learning.
- describe the difference between problem-oriented and associative learning by identifying an example of each.

SUPPLIES:

Observers' Report Sheet (one for each observer). These will be prepared by students on plain paper, or you may reproduce the sample included in the Suggested Teaching Procedures.

Master: Experiment II: Instructions for Experimenters (one for each experimenter)

EQUIPMENT:

Blindfolds (one for each subject)

Sound producers (one for each experimenter) These may be almost anything that makes a sound sufficiently loud for the subject to hear, but not so loud as to disturb the other subjects. It is far better if the sound producers are different--say, a "clicker," a very soft buzzer and a bell. If you cannot locate these, experimenters can resort to body sounds, such as a clap of the hands, a whistle or a stamp of the foot.

Feathers (one for each subject) These will be used to tickle the subjects' feet. Feathers are ideal, but if you can't obtain any, then soda straws, erasers or other objects may be substituted.

STUDENT TEXT:

What Is Learning? How Do We Learn? (homework assignment)

SUGGESTED TEACHING PROCEDURES:

[Read the Master.]

A. Selection of Experimenters: A class of about thirty students will be able to have three experiments going on at the same time; more experiments would probably be too noisy. If you have a small class (fewer than twenty students), two experiments will be enough. Each experiment will require an experimenter and a subject: the remaining students will observe.

Experimenters will need to read instructions hurriedly and will not be able to question you about them. The experimenters don't need to know at this time what they will be doing. Simply tell the students that they will be participating in an experiment that you cannot discuss yet, and that you need the number of experimenters you have decided on. As soon as these have been selected, give each of them a copy of the "Instructions for Experimenters," and tell them that they should go out of the room and carefully read the instructions.

B. Selection of Subjects: First ask whether anyone has read ahead; anyone who has should not serve as a subject. Next, ask for volunteers. The selection process will be more lively if you first ask whether anyone has ticklish feet. Then ask whether those with ticklish feet would be willing to serve as subjects in an experiment. Stress that they cannot be harmed and will not be ridiculed, but that they will serve as subjects and will have their feet tickled. As soon as the subjects have been selected, ask them to wait a moment while you check to see that the experimenters are ready for their subjects. (You can answer very quick questions from the experimenters outside the room.) Then send the subjects to join the experimenters outside the room.

C. Preparation of Observers: Explain the experiment quickly, since the subjects and experimenters will soon be ready. First, prepare Observers' Report Sheets. These should be on plain or lined sheets of paper. Each observer should prepare one according to your directions. A sample is included on the next page. (If you wish, you can make copies in advance.) Note that there are check marks in the TICKLE column for trials 1-5, 9-11, 15 and 21. Tell the observers that they will make check marks in the TWITCH column whenever the subject twitches, giggles or otherwise responds as if to a tickle. They will check only the TWITCH column; the experimenter will tickle only on the trials checked in the TICKLE column.

Explain what will happen, but don't take time to discuss the explanation at this time. All students need to know is that on every trial the blindfolded subject will hear a sound, then, in some trials, he will have his foot tickled. For each trial on which the subject responds, the observers should put a check in the TWITCH column on their Observers' Report Sheets.

OBSERVERS' REPORT SHEET (sample)

TRIAL	TICKLE	TWITCH	TRIAL	TICKLE	TWITCH
1	✓		16		
2	✓		17		
3	✓		18		
4	✓		19		
5	✓		20		
6			21	✓	
7			22		
8			23		
9	✓		24		
10	✓		25		
11	✓		26		
12			27		
13			28		
14			29		
15	✓		30		

You can also tell the observers, if they ask, that the purpose of the experiment is to see whether the subject associates the sound with the tickle. Observers should remain absolutely quiet so that the subject can hear the sound.

Tell the observers that neither they nor the experimenters will be allowed to talk during the experiment. This means that the experimenters must give a visual sign to the observers when it is time to start another trial. The experimenters have been instructed to nod as a sign that the next trial is about to start. When observers see their experimenter nod, they should pay attention to the subject, watching for any response he may give.

When the observers understand their instructions, divide them into groups of about equal size (one for each experiment) and send them to different areas of the room or, if possible, to different rooms.

D. Arrangement of Furniture: Little needs to be done here, and the observers can assist you. The idea is to provide a seat for the subject and a chair or platform on which he can rest his bare foot. (Note: if the shoe is left on one foot and the bare foot is elevated, the bare foot may be especially sensitive to tickling because the subject will be more aware of that foot.) The experimenter needs a seat in front of the chair or platform on which the subject will place his foot. He may also need room to use whatever sound producer is employed. Observers should sit so that each has a clear view of the subject's foot. When the furniture is arranged, bring in the experimenters and subjects.

E. Experiment: There is little for you to do. Be certain that each subject is blindfolded. The experiment itself should take only a few minutes, so take all the time you need beforehand to see that everything is right. Once the experiment begins, silence is desirable.

[Read "What Is Learning? How Do We Learn?"]

F. Discussion of Results: First, let the participants relax from the imposed silence. Before reassembling the class, ask each group to go over its observers' results and prepare a combined report sheet for recording on the chalkboard. (If there is dissension over whether a subject responded on a given trial, a question mark can be placed in the TWITCH column for that trial. If an observer lost track of the number of the trial being performed, there is nothing to do but ignore his results.) When the groups' reports are ready, have one member of each group record them while the other students take their seats.

There are a number of matters to discuss. Students have not yet read about associative learning, so the topic is open to speculation. You should conduct the discussion as you think best, taking the direction students pursue. A suggested sequence of questions follows.

1. Look at the results. Did any subject twitch when he wasn't tickled? Did his twitches form a pattern? Did the subject continue to twitch even when the tickle had not appeared for several trials? How do you explain this result?

2. Trials 9, 10,11, 15 and 21 are referred to as reinforcement. What do you think this word means? Why was the subject tickled on these trials?

3. The subjects learned. What did they learn?

4. This type of learning is referred to as stimulus-response (or S-R) learning. Why?

5. What are some examples of S-R learning that you have observed? Are they reinforced?

6. How does this learning differ from the learning that was observed in the previous, "connect the dots" experiment? (The answer to the last question centers on the distinction between associative learning and problem-oriented learning. For this discussion, it is enough that students see the basic difference. The assignment will provide them with more details.)

ASSIGNMENT:

For the next lesson, students should read "What Is Learning? How Do We Learn?" in the Student Text.

Note: The next lesson includes a somewhat complicated experiment. You should prepare the cue cards and instruction sheets in advance, and decide on the size of your groups you will use. See the next lesson's Suggested Teaching Procedures.

MASTER: EXPERIMENT II: INSTRUCTIONS FOR EXPERIMENTERS

You will administer an experiment to one subject. Several observers will watch and record what happens. Your responsibilities will be to prepare the subject, to perform a sequence of simple experimental operations on the subject, and to be sure that all observers are able to see and have time to record what happens.

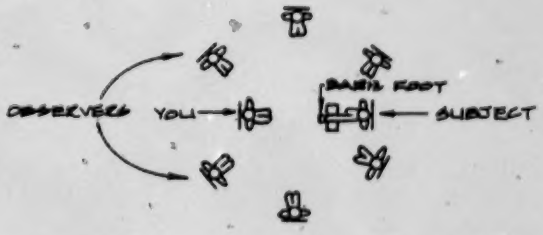
In this experiment the subject will present you with a bare, ticklish foot, expecting to be tickled. You will be given an object, such as a feather, which you can use to tickle the subject's foot. You might also be provided with a noisemaker, such as a bell or a buzzer, or you might be asked to create the noise by clapping your hands or stamping your foot. In the course of the experiment there will be thirty "trials." On every trial you will sound your noisemaker; on some trials, but not all, you will tickle the subject's foot immediately after you sound your noisemaker. On each trial, the observers will record whether the subject twitches, giggles or otherwise responds as if to a tickle.

On the first five trials you will both sound the noisemaker and tickle the subject's foot. On the next three trials you will sound the noisemaker only, and the observers will record whether the subject reacts to the sound as though it were a tickle. On most of the remaining trials you will sound the noisemaker only, but on a few of them you will also tickle the subject's foot. On each trial, the observer will record whether the subject responds as if to a tickle.

Below are more detailed, step-by-step instructions for conducting the experiment.

1. When you meet with your subject and your observers, get everyone seated in an arrangement something like that shown below. The subject's bare foot should be elevated, as on the seat of a chair. The observers should be seated so that they can see clearly how the subject responds each time you sound the noisemaker.

2. When everyone is seated, blindfold the subject. Be sure the subject is comfortable. Ask the subject to place his or her bare foot on the chair or other platform you have provided.



3. Next, prepare the subject for being tickled. Take your tickling instrument in hand and tell the subject that you are going to administer a preliminary tickle. Be sure that both the subject and the observers know you are not starting the experiment yet. Tickle the subject's foot for a second or two and ask whether that is a ticklish spot.

4. Tell the subject and the observers that the experiment will now begin. Be sure you have a pencil with which to mark off trials as you complete them. Have your noisemaker within easy reach, but do not make any noise with it until you are ready to begin the actual experiment. When you are ready, nod to the observers to signal that you are performing Trial 1. Sound your noisemaker briefly, then immediately tickle the subject's foot for about one second. Cross off "Trial 1" on the list below. Give the observers time to write down their observations; then nod to them again and perfor Trial 2. Cross off Trial 2, see that the observers have finished recording their observations, then nod and perform Trial 3. Continue in this fashion through all thirty trials. Note that on many trials you will sound the noisemaker only. On these trials, simply nod to the observers, sound the noisemaker briefly, give the observers time to record their observations, and then cross off the number on the following list.

TRIAL	1	SOUND	TICKLE	TRIAL	16	SOUND	
TRIAL	2	SOUND	TICKLE	TRIAL	17	SOUND	
TRIAL	3	SOUND	TICKLE	TRIAL	18	SOUND	
TRIAL	4	SOUND	TICKLE	TRIAL	19	SOUND	
TRIAL	5	SOUND	TICKLE	TRIAL	20	SOUND	
TRIAL	6	SOUND		TRIAL	21	SOUND	TICKLE
TRIAL	7	SOUND		TRIAL	22	SOUND	
TRIAL	8	SOUND		TRIAL	23	SOUND	
TRIAL	9	SOUND	TICKLE	TRIAL	24	SOUND	
TRIAL	10	SOUND	TICKLE	TRIAL	25	SOUND	
TRIAL	11	SOUND	TICKLE	TRIAL	26	SOUND	
TRIAL	12	SOUND		TRIAL	27	SOUND	
TRIAL	13	SOUND		TRIAL	28	SOUND	
TRIAL	14	SOUND		TRIAL	29	SOUND	
TRIAL	15	SOUND	TICKLE	TRIAL	30	SOUND	

Be sure that you tickle the subject only on those trials indicated above, and that you do not skip any trials or repeat any trials. Also be sure you allow plenty of time between trials for the observers to record their observations; otherwise some observers may miss some trials.

5. There must be no talking during the experiment. Neither you nor the subject nor any of the observers should say anything. If anyone speaks, ask him to be quiet.

6. At the conclusion of the experiment, remove the blindfold and tell the subject that his or her reactions will be discussed in class.

LESSON 6: ASSOCIATIVE LEARNING II: OPERANT CONDITIONING

SYNOPSIS:

A brief review of the reading assignment is followed by another experiment. The experiment is conducted on two or three groups, one of which is a control group. Some students serve as experimenters and recorders, but most serve as subjects. Subjects in the experimental groups receive verbal approval for certain responses; those in the control group receive no approval. Observers note whether experimental subjects tend to give the rewarded response more often than other responses. The class then suggests explanations for any differences between the responses of experimental subjects and control subjects.

OBJECTIVES:

The student will:

- participate in an experiment in operant conditioning either as an experimenter, recorder or subject.
- describe the results of the experiment and infer principles of operant conditioning.
- identify the function of a control group in an experiment on operant conditioning.

SUPPLIES:

Master: Experiment III: Instructions for Experimenter and Recorder (two copies for each group; instruction sheets must be prepared in advance as described in the Advance Preparations section below)

Master: Experiment III: Instructions for Subjects (one per student)

Pronoun Cue Card (one for each group, to be made in advance)

Verb Cue Cards (set of twelve, one set for each group to be made in advance)

Recorder's Tally Sheet (one for each group, to be prepared by the recorders from directions included in their instruction sheets)

ADVANCE PREPARATIONS:

A. Make Cue Cards: Each group will need a set of 13 cue cards, one showing three pronouns and each of the others showing one verb. The words should be printed in large capital letters, so that they can be read from several feet away. The cards can be prepared either by you or by students. It makes no difference whether students see the cards before the experiment begins. The words are listed below. Each of the twelve verb cue cards should be numbered with a small numeral in one corner, so that all the experimenters will be showing the verb cards in the same order.

Pronoun Cue Card

I...
YOU...
THEY...

Verb Cue Cards

1.	PLAY	7.	EXPERIMENT
2.	NEED	8.	DREAM
3.	LIKE	9.	WORK
4.	CHOOSE	10.	DO
5.	BELIEVE	11.	THINK
6.	EAT	12.	RUN

B. Prepare Instruction Sheets: The sheet entitled "Instructions for Experimenter and Recorder" includes instructions for (1) the control-group experimenter, (2) the experimental-group experimenter and (3) the recorders. To minimize confusion, you should prepare the instruction sheets as follows.

1. Experimenter, Control Group (one copy): Write the words "EXPERIMENTER--CONTROL GROUP" at the top of the first page. Cross out the entire paragraph headed "Experimental Group Only."

2. Experimenter, Experimental Group (one copy per experimental group): Write the words "EXPERIMENTER--EXPERIMENTAL GROUP" at the top of the first page.

3. Recorder (one copy for each group): Write the word "RECORDER" at the top of the first page. (Recorders' responsibilities are the same in all groups, control or experimental.)

C. Decide Experimental Procedure: All experimenters should use exactly the same procedure, except that the control-group experimenter will not give the experimental treatment described in the paragraph you have crossed out on his instruction sheet. Before the class convenes, you should decide how you can best arrange the furniture in your classroom so that the procedures will be the same in all groups.

It is best if the recorder and experimenter in each group have a table, but if this isn't possible they must have a desk top to use. Their subjects should face them. Either of two arrangements for subjects is possible. Either (1) the subject working on the task sits in a special chair in front of the experimenter and recorder, and returns to another seat when he has completed the task; or (2) each subject completes the task where he sits, without moving to a special chair.

For the purpose of this experiment it makes no difference which of these procedures is used. However, in order to ensure that the experimental conditions are the same in all groups, all groups must use the same procedure. You should decide in advance which procedure is best. The Suggested Teaching Procedures will tell you when to arrange the furniture and when to inform the experimenters of the procedure you have selected.

SUGGESTED TEACHING PROCEDURES:

A. Review of the Assignment: The bulk of this lesson is given over to Experiment III, so you should not spend much time discussing the assignment. Students will have more time to discuss the topic of learning during Lesson 9. However, you should answer any questions students may have about the distinction between associative learning and problem-oriented learning. Do not refer to Experiment III as one that deals with conditioning; if you did, some students might foresee the outcome and distort the results of the experiment.

[Read the masters.]

B. Selection of Experimenters and Recorders: Tell the students that they will be participating in yet another experiment, and that you will need some experimenters and some recorders. (You need two or three of each, depending on the number of groups you wish to establish.) There are no special qualifications for the positions of experimenter and recorder in this experiment. It would be a good idea to give these roles to students who have not yet served as experimenters.

When experimenters and recorders have been selected, distribute instruction sheets and cue cards to them as follows.

1. One experimenter should receive the instruction sheet that you have labeled "EXPERIMENTER--CONTROL GROUP." Do not say anything to this student about control groups, and ask the student not to read these instructions aloud or to discuss them.

2. Each remaining experimenter should receive a copy of the instruction sheet that you have labeled "EXPERIMENTER--EXPERIMENTAL GROUP." Ask these students not to read their instructions aloud or to discuss them.

3. Each recorder should receive a copy of the instructions that you have labeled "RECORDER."

4. All experimenters and recorders should receive the "Instructions for Subjects."

5. Each experimenter should receive one Pronoun Cue Card and one set of twelve Verb Cue Cards.

When these materials have been distributed, send all experimenters and recorders out of the room. Tell them that you will be with them shortly, and that in the meantime they should read their own instructions and the subjects' instructions and decide whether they have any questions. Do not take questions at the present time; the questions or your answers may influence the responses of the subject when the experiment gets under way.

C. Preparation of Subjects: There are three tasks to be accomplished. First, the remaining members of the class must be divided into three groups of equal size. (If you have fewer than 24 students, divide the class into two groups. Depending on the number of students present, one group may not be equal in size to the others, but the difference should never be greater than one.) One group will serve as a control, but you should not refer to groups as being experimental or control groups. Tell the students that all groups will be asked to perform the same task.

Your second task is to be certain that students understand what they are to do. Distribute the "Instructions for Subjects" and allow time for students to read the instructions. Answer any questions, but be very careful to avoid revealing the purpose of the experiment.

Stress one additional point that is included in the instructions. While one subject in the group is completing the twelve sentences, the others must remain silent.

The third task is to arrange the furniture for the experiment.

D. Briefing Experimenters and Recorders: When the room is arranged for the experiment, return to the experiments and recorders. First be sure that each person understands what his or her job is. Then tell the experimenters how you have arranged the furniture, so that they will know whether they are to call subjects to a special chair one at a time, or merely to address the task to each subject where he or she sits. Finally, answer any remaining questions. Then bring the experimenters and recorders back into the classroom and send them to their groups.

E. Experiment: Your role during the experiment is that of troubleshooter. Experimenters should be able to proceed without any problems, but you may need to remind subjects that they are to be quiet while other subjects are completing the task. Never interrupt a group while a subject is in the midst of the task, but if members of one group are disturbing others you can stop them between subjects and ask them to be quiet. When all subjects in all groups have completed their tasks, the recorders will need a little time to tally and compute the results. Experimenters can help them, and subjects can relax.

F. Display and Discussion of Results: If any time remains, display the results by asking the recorders for converted results (percentages) and compare the control group with the experimental groups. The next lesson includes a discussion of these results.

ASSIGNMENT:

If you wish to give an assignment, ask students to consider the results of today's experiment, comparing control and experimental groups, and to write generalizations that explain what happened and why.

MASTER: EXPERIMENT III: INSTRUCTIONS FOR EXPERIMENTERS AND RECORDERS

You will conduct an experiment in operant conditioning. The experiment is intended to illustrate that reinforcement of certain responses will condition subjects to give those responses more than others. Many experiments have shown that this is the case; today you will discover whether students in your class follow this pattern.

The design of the experiment is this: The students who are serving as subjects have been divided into two or three groups. You will be responsible for one of these groups. Subjects do not know whether they are members of a control group or an experimental group and you must not tell them. Subjects in both groups will perform the same task (making up sentences). In the control group no response is reinforced. In the experimental group, one response is reinforced. The results will show whether the experimental subjects use the reinforced response more often than the other two possible responses. In the control group all three possible responses should occur with about equal frequency. IT IS IMPORTANT THAT YOU KEEP ALL THIS INFORMATION ABOUT THE EXPERIMENT CONFIDENTIAL! IF THE EXPERIMENT IS TO WORK, SUBJECTS MUST NOT KNOW WHAT YOU KNOW. This can be difficult, and subjects may press you to tell them, but IT IS ESSENTIAL THAT YOU NOT REVEAL THE DESIGN.

The Experimenter's tasks are as follows:

1. Describe the task. Show the subjects a Verb Cue Card so they will know what to expect, and show them the Pronoun Cue Card so they will know their choices each time. Tell them you will show each subject, in turn, the Pronoun Cue Card and a Verb Cue Card. The subject will then state a complete sentence using one of the pronouns as the subject of the sentence and including the verb. When twelve sentences have been completed (one for each Verb Cue Card) that subject will have completed the task.

2. Tell subjects how you will proceed. Your instructor will tell you whether to have each subject, in turn, take a seat in front of you and the recorder, or to direct your cue cards to a subject where he or she is seated. Do not change the procedure.

3. Begin the experiment when subjects are ready and silent. Select a subject to start, and show him the Pronoun Cue Card and the first Verb Cue Card. (Cards are numbered, and you should go through them in numerical order.) When the subject has completed a sentence, show him the next Verb Cue Card and the Pronoun Cue Card. Continue until the subject has been through all twelve Verb Cue Cards and has completed twelve sentences. If the response isn't a sentence, say, "That isn't a complete sentence; try again." Do not encourage or discourage a subject or indicate in any way that one response is better than another. Do not proceed to the next subject until the present subject has completed twelve sentences.

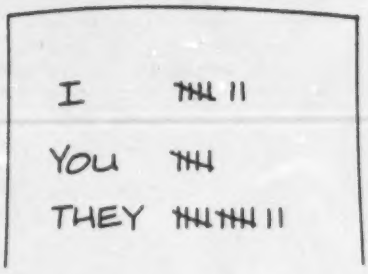
4. Experimental Group Only: Whenever a subject completes a sentence that begins with the pronoun "THEY," you must respond by saying, "Good!" (This is the reinforcement. If conditioning is working, when the experiment is completed the percentage of "THEY" responses will be greater than the percentage of "I" or "YOU" responses.) So remember, say nothing and make no facial expressions after "I" or "YOU" responses, but say, "Good!" to "THEY" responses. However, you must say nothing further to the subject, and you must not answer questions once the experiment has started.

5. Don't allow other subjects to assist the one who is completing sentences. The other subjects must be silent while a subject is completing sentences.

6. Start with any subject; it doesn't matter in what order they complete the task. You will have no more than ten subjects in your group, and probably fewer.

The Recorder's tasks are as follows.

1. Prepare a tally sheet. This is a plain piece of paper with the pronouns "I," "YOU" and "THEY" written along the side, with room for tallies beside each. After two subjects have completed the task, your tally sheet might look like this:



you will have twelve tally marks for each subject -- never more or fewer. Use the same tally sheet for all subjects in your group.

2. When a subject states a sentence, make a tally mark beside the pronoun he or she uses as the subject of the sentence. The sentence itself is unimportant, but the pronoun is important.

3. When all subjects have completed twelve sentences, add the results and convert to percentages. The formula for doing this is as follows:

a. Determine the total number of responses (number of subjects in the group times twelve).

b. Find the total number of "I" responses.

c. Find the total number of "YOU" responses.

d. Find the total number of "THEY" responses.

e. Divide a into b, then a into c, then a into d and multiply each quotient by 100 to get the percentages of "I," "YOU" and "THEY" responses made by the group. Report these when your instructor asks for them.

When all subjects have completed the task and while the recorder is figuring the results, the experimenter can tell the subjects that the purpose of the experiment will be revealed in the class discussion that will follow.

MASTER: EXPERIMENT IV: INSTRUCTIONS FOR SUBJECTS

Today you will participate as a subject in an experiment. You will not be told what principle is being tested until the experiment is completed. If you knew the purpose of the experiment before you participated, the results would be changed. You will be asked to do the same thing that all other subjects are asked to do; you will not be put "on the spot."

When the experiment begins you will be assigned to a group. You and all other subjects in the group will be given the task of creating twelve sentences that include a pronoun and a verb. The details are as follows.

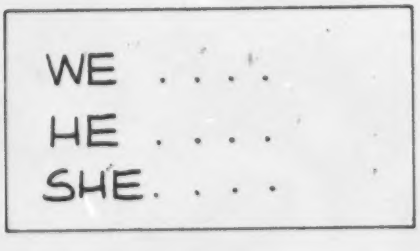
1. The experimenter will select a subject to begin. That subject will be shown a Pronoun Cue Card with three pronouns printed on it, and a Verb Cue Card with one verb printed on it. The subject is to create a sentence using one of the three pronouns as its subject, and also using the verb. When this is done, the subject will be shown a new Verb Cue Card and the same Pronoun Cue Card. Again, the subject will create a sentence using one of the three pronouns as its subject, and using the verb on the new card. This procedure will be followed twelve times (with twelve different verbs). Then a second subject will attempt the same task.

2. You will be given time to create the sentences. You do not need to rush through the experiment. Some possible responses are better than others. The recorder will be listening for these.

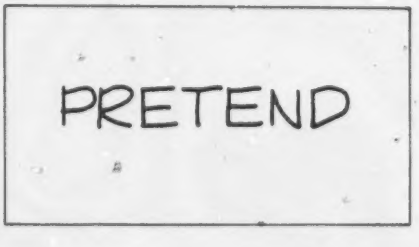
3. If your response is not a complete sentence, the experimenter will tell you that you have not created a complete sentence, and will give you time to create one. The experimenter will not assist you, and will insist that each subject create twelve sentences.

4. If you are not taking your turn (if you are not the subject creating the sentences) you must remain silent. You may not assist the subject who is attempting to create sentences, and you may not speak with other subjects. To do so would possibly change the results of the experiment.

Here's an example of how it works: Suppose you were the subject and you saw a Pronoun Cue Card like this:



and a Verb Cue Card like this:



You could say, "She pretends she's friendly, but she's not." Or you could say, "We used to pretend we were astronauts when we were little kids." Or you could say, "He pretends to like this class when the teacher's around." All these sentences fill the requirements of the experiment; each uses only one of the pronouns, and each uses the verb on the card. You could also say, "Does she pretend a lot, or is she sincere?" That also meets the requirements, even though the sentence is a question. That's all there is to it. Because you must remain silent (except to do the task), ask any questions now, while you have a chance.

LESSON 7: INSIGHT LEARNING

SYNOPSIS:

There are two parts to this lesson: a discussion of Experiment III and the execution of Experiment IV. The discussion should continue for about half the period. Then students attempt to solve a problem that requires tying two ropes together. The solution illustrates insight learning.

OBJECTIVES:

The student will:

- identify the purpose of a control group in an experiment.
- distinguish between respondent and operant conditioning as forms of associative learning.
- observe or participate in the use of insight in a problem-solving experiment.

EQUIPMENT:

String, about five meters in length (longer if your classroom's ceiling is more than 8 ft. high)
One pair of pliers or similar tool (no scissors!)

ADVANCE PREPARATIONS:

Before class begins, cut the string in half and suspend the two lengths from the ceiling. For the average ceiling height (about eight feet) the two strings should be just over two meters in length and just under four meters apart; the bottom ends of the strings should be about two feet off the floor. If the ceiling is higher, the strings will have to be longer and farther apart.

To test the length and placement of the strings, consider the following. First, the two strings should be far enough apart that one person cannot hold on to one of the strings with one hand and touch the other string with the other hand at the same time. Second, the two strings should be close enough together that, if two persons were involved and each were holding one string, they could bring the two strings together and tie them at the bottom end.

Note: The strings must be securely attached at the top end, so that either string could support the weight of the pliers if they were tied to the bottom end of the string. The classically elegant solution to the probelm will not work if this condition is not met.

SUGGESTED TEACHING PROCEDURES:

A. Discussion of Experiment III: There are a number of points to be made about Experiment III. If you gave a written assignment it can serve as a basis for discussion. The following questions are suggested as a sequence for the discussion. Because the experimenters and recorders have special knowledge of what was being tested, try to elicit answers from subjects during the first part of the discussion (If you have not yet displayed the results, do so now).

1. What was being tested? What principle of learning was under observation?

2. How does it differ from the types of learning observed in Experiment I and Experiment II? Experiment I was problem-oriented, and trial-and-error was probably the most frequently used learning style. Experiment II and III illustrated associative learning, but there is a difference between them. Students should be able to point out the difference. In Experiment II [respondent conditioning] the subject responded to a stimulus [a tickle]. Then a second stimulus [the sound] became associated with the first, and the subject may have responded to the sound as though to a tickle. In Experiment III [operant conditioning] the subject initiated the response [saying "They"] to receive a rewarding "stimulus" [an expression of approval

from the experimenter]. In Experiment III the subject was, in a sense, manipulating the environment.)

3. Why was a control group used? (The purpose of the control group, of course, is to determine what will occur without the experimental treatment--the reward for a "They" response. Only with a control group can one see how the experimental treatment may have influenced the behavior of the experimental subjects.)

4. If the experiment did not show the experimental groups being different from the control group (responding with "They" more often than the control group), how can this result be explained? (The answer to this question is probably unique to your class. The experimenters may not have done an adequate job. Or the experimenters may have done their job, but the reward may not have been seen as a reward by the subjects. You'll need to work this out with the students.)

5. Some subjects were observers until their turn. Could this affect results? How? (It's possible that the positive rewards in the experimental group gave subtle cues to subjects awaiting their turn.)

6. Are there situations you can think of in real life in which people have been conditioned to behave in a certain way in order to get a reward? (Biofeedback training, discussed in Science Unit IV, Section 4, is an excellent example of operant conditioning. The reward is relief from or prevention of a symptom or disease.)

C. Experiment IV: This experiment may take only a few minutes, depending on how quickly the subjects discover the answer. Therefore, proceed carefully, and don't let subjects discuss possible solutions among themselves. First, ask for five volunteers for subjects. When you select subjects, avoid very tall students; someone over 2 meters in height may be able to reach both strings by jumping. Bring the subjects to the front of the room and seat them in a row, facing away from the strings. Show them all the pair of pliers. Tell the subjects, in front of the class so the other students will also know what is occurring, that the task in this experiment is to bring the two lengths of string together at their lower ends without pulling either string down from the ceiling or cutting either string, using nothing but the pliers you have shown them. They will proceed in turn, and will not see how the preceding subjects solved the problem. Each subject will have time either to solve the problem or to give up. At this point ask the subjects to hold up their hand if they know the answer (have seen or read about the problem before). Replace any subject who knows the answer.

When five qualified subjects have been selected, choose one to begin. Be certain that the other four will not be able to observe his attempts. Tell him that you can answer no further questions, and that he will have to proceed on his own. No other person may help him in any way, and no object may be used except the subject's body, the two strings and the pliers. (For example, the subject is not permitted to stand on a chair.)

When the subject has discovered a solution to the problem (either the classical solution, in which one string is turned into a pendulum, or another solution) or has given up, let the next subject attempt the problem. Continue in the same fashion with all five subjects.

It is possible that all five subjects will see the answer immediately, but it is not likely. If a subject doesn't see the solution immediately, it will be instructive for the class to observe him thinking through a problem. When the answer arrives, it arrives in a flash of insight. When the experiment is completed, and if there is time, you can begin the discussion.

D. Discussion of Experiment IV: The reading assignment for Lesson 9 will provide students with more information on learning. For today, it is enough to let students realize that the solution to Experiment IV if found through trial and error and insight, as was the case in Experiment I.

ASSIGNMENT:

There is no assignment.

LESSON 8: THE PROBLEM-SOLVING PROCESS

SYNOPSIS:

The first half of this lesson consists of an exercise in which students attempt to discover the criterion used to distinguish between two types of statements. You will ask the class to make statements about a student, and you will identify each statement as "Type A" or "Type B." Through speculation and hypothesis-formation and -testing, students will discover the "right answer" using inductive and deductive processes. The second half of the lesson is a discussion of these processes and of the place of insight in problem analysis. The homework assignment is a reading on insight learning.

OBJECTIVES:

The student will:

- use the processes of induction and deduction in a problem-solving exercise.
- identify steps in the process of forming and evaluating a hypothesis.
- distinguish insight and trial-and-error learning by providing examples of each.

STUDENT TEXT:

Learning Through Insight (homework assignment)

ADVANCE PREPARATIONS:

The thinking processes investigated in this lesson--hypothesis formation and inductive and deductive reasoning--are the core of the scientific method of research in both the natural and the social sciences. Before teaching this lesson you may wish to discuss the activity with your Biomedical Science colleague, for the purpose of designing an interdisciplinary discussion (to be conducted in either class) on the nature and the uses of the scientific method. The Science instructor may be able to describe natural-science experiments with which your students are familiar and in which experimenters have inductively formed hypotheses and deductively tested them. A review discussion of these experiments, in terms of inductive and deductive reasoning, should serve to reinforce the learnings from this activity as well as any connected with the experiments you choose to discuss.

SUGGESTED TEACHING PROCEDURES:

A. Review of the Previous Lesson: Spend a few minutes going over the results of Experiment IV. The point of this review is to remind students of the use of trial and error and insight in problem-solving. When you believe students understand this point, tell them that they will now be faced with a situation in which insight may assist them, and that they will be able to test the accuracy of their insights.

B. Exercise: Ask a student to assume a seat in the room that is in full view of the rest of the class. Then tell the rest of the students that they are to make statements about this student, and that after each statement you will tell them whether they have made a Type A or a Type B statement. Their "problem" is to formulate a definition of Type A statements and a definition of Type B statements. Before beginning, students may take a sheet of paper and write two column headings: TYPE A and TYPE B. By writing down statements in the appropriate columns, they may be able to discover a difference between the two types of statements. This part of the exercise is not required, but students may find it useful.

When the student is in view of the class, begin. As soon as a statement is made, identify it as Type A or Type B but do not offer any other information. Type A statements are those which report facts that can be verified or refuted by observation at the time the statement is made. Type B statements are those which report

unobservable facts, i.e., those which are based on inference. If the statement cannot be tested by observing the student at the moment, it is not a Type A statement. For example, "Bill is wearing tennis shoes" is a Type A statement. True statements can still be Type B statements. "Bill is on the basketball team" is a Type B statement because it cannot be verified by observation at that time. "Bill is wearing a blue shirt" is a Type A statement even if Bill is, in fact, wearing a red shirt; the statement can be verified or refuted by observation. "Bill has won a letter in basketball" is a Type B statement, even if Bill is wearing a letter; that he has won the letter is an inference. "Bill is wearing a letter" is a Type A statement, whether Bill is wearing a letter or not.

After a few statements have been made and identified, ask whether anyone can speculate on the definition of a Type A statement. When you do get a response, tell the student that this is a hypothesis.

Ask how the student would test the hypothesis. How would he discover whether his answer (his hypothesis) is correct? Students should be encouraged to go through this process of encountering a problem, speculating on a solution and evaluating the speculation. The evaluation is straightforward: by constructing sentences that meet the definition stated in his speculation (hypothesis), the student can determine whether your responses are consistent with his definition.

For example, a student may say that a Type A statement is a true statement. Ask him to state his hypothesis clearly. Use the board if possible. The student should be able to state, "All true statements about Bill are Type A; all false statements about Bill are Type B." When testing this hypothesis, the student may make a false statement that can be verified or refuted by observation. You will respond that it is a Type A statement. The student will then know that his hypothesis is incorrect.

Continue to identify statements made by students until someone else is ready to hypothesize. It should not be very long before someone offers the correct definition. When someone does offer it, do not acknowledge it immediately. Encourage students to submit it to several "tests" by constructing sentences that fit the definition and seeing that your responses confirm the hypothesis.

C. Discussion of the Exercise: Students should be encouraged to review the process by which they learn the distinction between Type A and Type B statements. They should be able to identify some similarities and some differences between this process and the processes they have used in earlier experiments. For example, the learning in this activity was not purely the result of trial and error. (It would have been, if students had made no statements and heard no responses from you, but had simply begun guessing what the difference was.) Insight learning was probably involved: after hearing your responses to several statements, a student may have discovered the difference between types of statements in a "flash," after some confusion. Associative learning was not involved in the activity.

In discussing what actually did happen in this exercise, ask students to consider the differences between (1) the process by which they arrived at hypotheses and (2) the process by which they tested thier hypotheses. These are essentially the processes of induction and deduction, respectively. Forming the hypotheses was an inductive process that began with particular data (your responses to particular statements) and proceeded to a generalization (a guess about what distinguishes Type A from Type B statements in general). Testing the hypothesis was a deductive process that began with the generalization and proceeded to the consideration of your responses to particular statements. When students have discovered this distinction, they should be asked to provide additional examples of the use of these two processes.

Expand the discussion to include consideration of ways in which people use induction and deduction in responding to real situations. The steps in solving real problems differ slightly from those used in this exercise, but students can easily see the parallels:

1. encountering a dilemma or problem
2. defining the nature of the problem

3. considering possible solutions

4. testing a solution

5. acting on the solution (if the solution is correct)

or 6. going back to "4" and testing another solution (if the previous solution was incorrect)

Students can see these steps if they are asked to go through the process they would use in encountering a dilemma in real life. Spend some time considering sample problems and ways in which they are resolved. Students should be able to see that through induction answers are discovered, and through deduction the answers are tested and applied to new but similar situations.

These processes are frequently used with such rapidity in our minds that they are not easily identified. For example, in Experiment IV subjects probably considered a number of ways to connect the two pieces of string before insight led them to the correct solution; they did not take time to write down or try out every possibility that occurred to them, but they were reasoning inductively. Once the pendulum principle had been established, the solution to any similar situations could be based (deductively) on that principle.

ASSIGNMENT:

[Read "Learning Through Insight."]

Assign the reading "Learning Through Insight," in the Student Text.

LESSON 9: SUMMARY OF LESSONS ON LEARNING

SYNOPSIS:

This lesson is a discussion of the reading, "Learning Through Insight," which was assigned for today.

OBJECTIVE:

The student will identify distinctions among types of learning and provide examples of each type.

SUGGESTED TEACHING PROCEDURES:

This discussion is intended to serve as a summary of the past five lessons. The following suggestions may be of help.

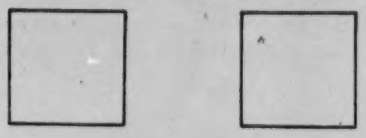
1. There are a number of terms in the reading. It is best to use these in context, because students can become confused and attempt to memorize each term even though they may not understand it.

2. Specific examples of each type of learning should be generated by students. Rather than asking for an example of a particular type, ask for any situation in which learning has occurred (remember that a lasting change in behavior is a type of learning), and then ask another student to classify it by type. This will help students see that they use all types of learning, rather than cause them to try to think of examples to fit the classifications.

3. Some examples will be confusing because more than one type of learning is involved. This is to the good because it will stress the important point that learning is seldom accomplished in a simple and singular manner.

4. Students have not experimented with the third general type, learning from an external source. However, they have had much experience with it. A simple demonstration of how meaningful material is more easily retained is the use of eight lines of equal length. Draw these on the board in random arrangement:

Cover them (by pulling a map or projection screen down over them) and ask the students whether they could reproduce the lines exactly as they were drawn on the board. Then draw an additional eight lines of equal length to the first eight, but arranged as follows:



Now ask students if they could reproduce these. The point is easily made that meaning is useful when material is received from an external source.

5. An alternative or additional procedure for reviewing types of learning is to ask students to suggest any kind of behavior that they consistently exhibit, or any kind of knowledge that they have, and then to ask them how they acquired the behavior or the knowledge. Review the steps in the learning process in as much detail as is possible, and ask students to identify the type or types of learning involved in the acquisition of the behavior or knowledge.

ASSIGNMENT:

There is no assignment.

LESSON 10: THREE INTELLECTUAL TASKS

SYNOPSIS:

In this lesson students reason through written versions of three intellectual tasks. After they have answered questions about the tasks, they will discuss whether six- and eleven-year-olds would be able to perform the same tasks and whether they would perform them in the same way your students did. The homework assignment is a reading based on the three tasks.

OBJECTIVES:

The student will:

- describe how he would perform three intellectual tasks.
- speculate on the ability of six- and eleven-year-old children to perform the same tasks in the same way.

STUDENT TEXT:

Three Tasks

An Experiment Using Three Tasks

SUGGESTED TEACHING PROCEDURES:

[Read "Three Tasks."]

The lesson begins with a simulated experiment. Ask students to read "Three Tasks," in the Student Text, and to write answers to the questions on a separate sheet of paper. When everyone has finished writing out the answers, go over the tasks one by one, beginning with Task I. Ask for answers to each question and reasons for each answer. Note whether students give different reasons for their answers to the same question. When you have finished going over the tasks, point out any differences among the reasons given for any particular answer, and observe that different individuals appear to have reasoned through the same task in different ways.

Next, ask the students whether they believe eleven- or twelve-year-olds are able to perform the same tasks. Some will believe they are, and others won't. Encourage this diversity. Use the board to record speculations, or hypotheses, about the ability of eleven- and twelve-year-olds to do these tasks.

Ask whether those students who believe the younger children could do the tasks also believe the younger children would perform the tasks in the same way or give the same reasons as senior Biomedical students. Again, record both positive and negative speculations.

Next, pursue the same sort of discussion, but focus on six-year-olds.

Encourage the class to take positions on the abilities of younger people to do these tasks and on the ways in which they would do them and the reasons they would give for their answers. Once the students realize they have come up with several hypotheses, or speculations for testing, you can explain that they will perform an experiment designed to prove or disprove their hypotheses about reasoning in younger children. Make a permanent record of the hypotheses the class has generated,

ASSIGNMENT:

[Read "An Experiment Using Three Tasks."]

Ask the students to read "An Experiment Using Three Tasks," in the Student Text.

LESSONS 11-14: EXPERIMENT USING THREE INTELLECTUAL TASKS

SYNOPSIS:

In this sequence of lessons students prepare for, conduct, discuss and tabulate data from an experiment on elementary-school students' performance on three intellectual tasks. In the first lesson students practice on one another. In the second lesson they perform the experiment with the children. In the third and fourth lessons they discuss their experiences with the experiment and tabulate the data. The data will be used in Lesson 15 to test hypotheses your students formulated in Lesson 10.

Note: Lesson 12 requires a field trip to an elementary school. See the Advance Preparations section, below, for further information.

OBJECTIVES:

The student will:

- administer three intellectual tasks to an elementary-school-aged subject.
- record data on a subject's performance on the tasks.
- tabulate data from the experiment.

SUPPLIES:

For each pair of students:

Master: Tally Sheet for Three Tasks (four copies)

Four transparent containers: two identical (A and B), one taller and narrower (C) and one wider and shallower (D); the amount of water that half-fills container A should not overflow either container C or container D.

Enough water to half fill beakers A and B

A few drops of food coloring (any color)

Two balls of clay, about one inch in diameter, that will not get mushy in water.

The Biomedical Science teacher may be able to help you line up these supplies. Students may be able to bring some supplies from home.

STUDENT TEXT:

An Experiment Using Three Tasks

ADVANCE PREPARATIONS:

This set of lessons requires you to make some special arrangements. First, it is necessary for your class to travel to an elementary school. Your students will need to work with elementary-school students in two different age groups: (1) ages 6-7 and (2) ages 11-12. You will need this number of elementary-school students: one age 6 or 7 for every two of your students, and one age 11 or 12 for every two of your students. If your Biomedical class numbers 30, you will need 15 students ages 6-7 and 15 students ages 11-12.

Your class will be divided into pairs; each pair will work with one 6- or 7-year-old and with one 11- or 12-year-old. The instructions for the activity assume that students will work with the younger children first, but this assumption is only for the purpose of matching the chronological sequence of testing with the chronological ages (and, possibly, developmental stages) of the subjects. No harm will be done if the older children are tested before the younger children.

There must be some privacy for each test group (a pair of your students and one subject) to prevent subjects' overhearing one another's responses. It might be possible to place test groups in different classrooms or to spread them out in an auditorium or similar facility, but be sure that any laws regarding supervision of the children by credentialed personnel are adhered to. The instructions call for administration of tasks on a table, but a horizontal desk top or even the floor will work.

Note: This Social Science field trip may occur at about the same time as a Science field trip to an elementary school (Science Unit IV, Lesson 35) in which your students will administer a vision-screening test to elementary-school children. It may be possible to combine the two field trips, and you should discuss this possibility with the Biomedical Science instructor well in advance. The Social Science activity at the elementary school will occupy only about 45 to 60 minutes: 15 minutes for setting up and cleaning up, 15 to 20 minutes with the younger subjects (ages 6 and 7) and 15 to 20 minutes with the older subjects (ages

11 and 12). The Science activity will also take about an hour. It should be possible, therefore, to complete both field-trip activities in approximately two hours, assuming that arrangements with the elementary-school staff are completed well in advance.

SUGGESTED TEACHING PROCEDURES:

A. Practicing the Tasks: The first day of this sequence is devoted to practicing the tasks. The students will need all the supplies listed at the beginning of the lesson. Note, however, that two Tally Sheets per pair of students must be saved for the actual administration of the tasks to the elementary-school children in the second lesson of the sequence.

First, divide the class into pairs. Each pair will work together both during this practice session and during the actual experiment in the next lesson. Distribute two copies of the Tally Sheet to each pair. Using the instructions given in "An Experiment Using Three Tasks," in the Student Text, ask one student in each pair to administer Task I to the other student and to record the responses on a Tally Sheet. Then ask the two students in each pair to exchange roles and again run through Task I.

You may hear some grumbling about this practice; if so, explain that psychologists who perform experiments of this kind often receive a year or two of training before they are allowed to conduct an experiment on real subjects.

As students are practicing Task I, watch for an error that is commonly made by experimenters administering tasks such as these. The experimenter may unconsciously give nonverbal cues to the subject; for instance, the experimenter may make a face when the subject gives the wrong answer or, perhaps, barely shake his head up and down when the subject starts to give a correct answer. These cues will definitely affect the results of the experiment. Students should be made aware of them and should strive to eliminate them. Students can watch each other for evidence of nonverbal cues during this practice session.

Now the students may practice Task II; emphasis is on asking the questions properly, preferably memorizing them and the manipulations involved. A good experimenter shouldn't have to look at his notes. Again have the two students in each pair administer the task to each other.

Last, practice Task III.

B. Assignment: Suggest that students who have younger brothers or sisters go home and try out these tasks with the younger children. This experience will help prepare them for what the elementary-school children may do or say.

C. The Experiment: On the second day of this sequence, take your class to the elementary school. Once there, allow each pair of students to set up their materials for the experiment. Remember: Some degree of privacy is needed; the subjects should not be able to overhear each other.

Begin with the younger subjects if it is convenient to do so. One young child is the subject for each pair of your students. It will take 15-20 minutes for your students to administer the tasks. When all the younger subjects have completed Task III, these subjects may return to their classes.

Now repeat the experiment with the other group of subjects. One child is assigned to each pair of your students. Your stucents switch roles when these subjects come in. When all these subjects have completed Task III, the experiment is concluded. The children can return to their classes and your class is ready to return to your school.

It would be a good idea to collect the Tally Sheets, making sure each recorder has put his name on the sheet, and pass them out again at the beginning of the third lesson of the sequence.

D. Discussion of the Experiment: Part or all of the third lesson should be devoted to discussion of what happened during the experiment. Begin by asking the students to describe how they felt about carrying out the experiment. Were they surprised at how the subjects responded? Did any of your students run into a problem? What was it? How was it resolved? How did the students feel in the role of experimenter? Recorder?

Then go to Task I. Ask what responses and reasons the younger subjects gave, then ask what responses and reasons the older subjects gave. Finally, ask your students to draw some tentative conclusions from the difference between the young children's and the older children's answers and reasons.

Discuss Task II and Task III in the same fashion.

E. Data Tabulation: Following the discussion of the experiments, you should begin the data tabulation. All of the fourth lesson of the sequence may be devoted to tabulation. You will probably need a section of blackboard on which the writing can be "saved" for several days. An alternative is to appoint someone as tabulator to record the data on a sheet of paper. An outline for a tabulation sheet is found on the next page.

The statements on the left-hand side of the tabulation sheet represent answers the subjects will have given to your students' questions. The boxes on the left break down "yes" and "no" answers by age group; each cell denotes the number of "yes" or "no" answers given by all the subjects of one age group.

Complete the tabulation by asking each of your students to raise his hand if the Tally Sheet he filled out has an X in the cell you call out. For example, if you call out, "Task I, Question 2, 6-7 year olds, yes," and point to that cell on your table, then all students who have a response for that cell on their Tally Sheets should raise their hands. You then count the hands and enter the total in the cell. Use only half the cell; the other half will be used to enter a percentage figure, which will be computed after the tabulations have been completed.

Continue with this procedure until you have filled all the cells. You can check whether your tabulations are correct by adding the "yes" and "no" answers for each question, for each age group. The sum for each question should be the same as the number of subjects in that age group.

When you have completed the tabulations, stop for a few minutes to ask the students whether they can make any inferences from the tables. What will most likely turn out is that the number of responses in the "yes" rows will increase from the younger to the older age group.

Now, the class should compute the percentage for each cell by dividing the total number of students in the age group into the number in the cell and multiplying by 100. Write the percentage you get in the right half of the cell. The percentages will form the basis of the next lesson.

OUTLINE FOR TABULATION OF THE DATA ON PIAGETIAN TASKS

Task I: Conservation of Quantity

*2. Water in containers A and C equal — 6-7(n=__) 11-12(n=__)

	6-7 no.	6-7 %	11-12 no.	11-12 %
yes				
no				

3. Water in containers A and D equal

	6-7 no.	6-7 %	11-12 no.	11-12 %
yes				
no				

Task II: Conservation of Substance

*2. Round ball and "sausage" equal — 6-7(n=__) 11-12(n=__)

	6-7 no.	6-7 %	11-12 no.	11-12 %
yes				
no				

Task III: Conservation of Volume

*3. Water level predicted to go up same when "sausage" and round ball of clay are added — 6-7(n=__) 11-12(n=__)

	6-7 no.	6-7 %	11-12 no.	11-12 %
yes				
no				

Instructions:

Enter the total number of subjects making particular response in the appropriate cell. Divide these totals by appropriate "n" and multiply by 100 to obtain percentages.

* Questions that all subjects should have answered "Yes" have been omitted from this tabulation sheet.

TALLY SHEET FOR THREE TASKS

Age of subject: (circle one) 6-7 11-12

Task I: Conservation of Quantity

	yes	no	reasons
1. Water in containers A and B equal			
2. Water in containers A and C equal			
3. Water in containers A and D equal			

Task II: Conservation of Substance

	yes	no	reasons
1. Round balls of clay equal			
2. Round ball and sausage equal			

Task III: Conservation of Volume

	yes	no	reasons
1. Water in containers A and B equal			
2. Water in A and B goes up same amount when balls of clay are added.			
3. Water level predicted to go up same when "sausage" and "round" ball of clay are added.			

Recorder _____

Experimenter _____

LESSON 15: CONCLUSIONS FROM THE DATA

SYNOPSIS:

In this lesson students draw conclusions from their data and test their hypotheses (from Lesson 10) against the data. The homework assignment is a reading about the Piagetian theory of intellectual development.

OBJECTIVES:

The student will:

- analyze the data tabulated in Lesson 14.
- draw conclusions about intellectual development, based on the data gathered.
- evaluate conclusions advanced in class.
- use the data to test hypotheses previously generated by the class.

STUDENT TEXT:

A Theory about Cognitive Development (homework assignment)

SUGGESTED TEACHING PROCEDURES:

A. Inferences from the Data: Discuss first Task I, then Task II, then Task III. In discussing each task, ask students to compare the performance of 6- and 7-year-olds with the performance of 11- and 12-year-olds. Encourage students to state generalizations on the basis of the data, particularly generalizations comparing or contrasting the performance of the two age groups on the tasks. Encourage the class to offer criticisms and improvements of the generalizations offered.

B. Testing Hypotheses: In Lesson 10 your students formulated some speculations, or hypotheses, about the performance of younger children on these tasks. Ask the students now to compare their hypotheses with the generalizations they have just been drawing from the data and to decide which hypotheses are supported by the data. Students will be aware that the groups of subjects they tested were not scientifically selected to be representative of their age groups as a whole. Students should be encouraged to discuss the following questions.

1. Could the groups tested by considered more or less representative of some larger populations (e.g., children their ages who attend their schools, or who live in their town or neighborhood)? Why or why not?

2. What procedures would students use to select samples of elementary-school children representative of (a) their age groups in their school, (b) their age groups in their community or (c) their age groups in larger areas such as the state or the nation? (Random selection of names from the rolls of one school or from the rolls of all elementary schools in the community would approximate representative samples in cases a and b; analysis of demographic characteristics such as race or ethnic group and family income would be necessary to select random samples of larger populations.)

ASSIGNMENT:

[Read "A Theory about Cognitive Development."]

Tell the class that two Swiss psychologists, Jean Piaget and Bärbel Inhelder, developed the tasks the students used, and that these psychologists have used these and similar tasks in developing and testing a theory about cognitive development in children. The theory is outlined in the reading "A Theory about Cognitive Development," in the Student Text.

LESSON 16: PIAGET'S THEORY OF COGNITIVE DEVELOPMENT

SYNOPSIS:

This lesson is a discussion of the reading, "A Theory about Cognitive Development," in the Student Text. The four periods of development Piaget describes are the basis for the discussion; students are asked to describe each developmental period and give examples from their experiment which illustrate a child's thought in Periods II and III. A written assignment reinforces the reading.

OBJECTIVES:

The student will:

- describe the four periods of cognitive development described in Piaget's theory.
- give examples reflecting at least two of the four periods.

STUDENT TEXT:

A Theory about Cognitive Development (for discussion in class)
Assignment: Explaining a Health Problem (homework)

SUGGESTED TEACHING PROCEDURES:

Discuss the reading to help students better understand Piaget's periods of development and to compare Piagetian periods with the results of their own experiment. (The tasks they used discriminate between Piaget's Period II and Period III.) Ask the students whether there are any parts of the reading that they would like to have clarified; other students may be able to answer their questions. Then move into a discussion of each of the four periods of cognitive development. Ask students to characterize thought processes in each of the four periods.

When you discuss Periods II and III, it is important that the students decide whether their experiment actually distinguished between these two periods. Ask the students whether they were able to distinguish two different levels of thinking in the children's approaches to the tasks in the experiment. If they did see two kinds of approaches, do the students believe the two approaches confirm Piagetian theory? Why or why not?

During this discussion it is important to emphasize that, according to Piaget's theory, different children progress through the stages of development at different rates. A child who is at a lower stage of development than is average for his age group is not necessarily stupid or permanently retarded. It is likely that the child will continue to progress, and entirely possible that his rate of progress will increase. What period a child is in at the moment is no basis for predicting either how far or how fast the child will progress in the future.

Students should be encouraged to relate Piaget's theory of development to real-life processes in which older people communicate with younger people, particularly child-rearing, education and relationships between siblings of different ages. How might parents help small children grow intellectually, without causing them to become frustrated and discouraged? How might elementary-school teachers use Piagetian theory to help make their instruction appropriate to their students' abilities to learn? How should older brothers and sisters respond to the ideas and the problem-solving attempts of younger children in their family?

Finally, you might introduce the question of the usefulness of Piagetian theory to health professionals who work with children. This question is the topic of the homework assignment, and some preliminary discussion might help.

ASSIGNMENT:

[Read "Assignment: Explaining a Health Problem."]

Students are to write an essay in which they apply what they have learned about cognitive development to a health-care problem. The task is described in the assignment "Explaining a Health Problem," in the Student Text. Note that the assignment calls for students to review information related to the health problem, found in the Biomedical Science Student Text, Unit IV, Sections 21 - 23.

LESSON 17: AN APPLICATION OF COGNITIVE DEVELOPMENT TO HEALTH CARE

SYNOPSIS:

This lesson is a discussion of the homework assignment, which was to write a brief essay explaining a temporary hearing loss to three young patients, basing the approach on the students' experiment and on Piagetian theory. The explanations students give should vary considerably according to the periods of cognitive development the patients are in. Students should also discuss Piaget's observations about cognitive development in people of their own age.

OBJECTIVES:

The student will:

- apply his knowledge of cognitive development to a health-care problem.
- analyze and evaluate examples presented in class of ways to explain a temporary hearing loss to patients of different ages.

ADVANCE PREPARATIONS (Optional):

It might be desirable to expand this lesson to include a guest speaker who is familiar with the difficulties of communicating with young children about health problems. Among the kinds of people who might make interesting guests are school nurses, physical therapists, speech pathologists, audiologists and pediatricians. The guest speaker might also be able to contribute to the discussion in the second part of this lesson, on cognitive development in people of your students' own age group.

SUGGESTED TEACHING PROCEDURES:

A. Discussion of the Homework Assignment: Begin by asking students what criteria they had to use in order to complete the assignment for each of the age groups. For example, they would have to keep the explanation uncomplicated, perhaps using pictures, in order to make the explanation meaningful to the five-year-old patient.

Next, call for examples of explanations to the five-year-old patient. Ask several students to read their explanations. Then ask the rest of the class to critique what has been read for fidelity to the class' experiment in the elementary school and to Piaget's theory. Is the right approach being taken for a child of that age? You may also wish to have the class evaluate the amount of information in each description. It is easy to give too much information when you know more about a topic than the person you are explaining it to. After the class has heard and evaluated 8 to 10 explanations for the five-year-old, move on to the nine-year-old and then to the sixteen-year-old.

B. Discussion of Adolescent Cognitive Development: Leave as much time as necessary for a thorough discussion of adolescent cognitive development: Where will these students go from here? Do they believe their cognitive development is complete? Or is there more to come? (It would be interesting to refer back to Piaget's statements about Period IV thinkers, as reported in the Student Text.)

One interesting point that should come up is that cognitive development itself may be complete in adolescents but their ability to react to, process and learn from new stimuli, new problems and new situations will continue developing throughout their lives.

ASSIGNMENT:

There is no assignment.

LESSON 18: SOME MORAL DILEMMAS

SYNOPSIS:

Students read a brief story that describes a young girl facing a moral dilemma. They then discuss the possible solutions to the dilemma and the reasons a person might have for selecting each solution. Three other dilemmas may also be read and discussed, depending on student interest. As a homework assignment, students write brief stories describing other moral dilemmas. In the following lesson students will discuss the hypothesis that people resolve moral dilemmas in different ways as they grow older, i.e., the idea of cognitive moral development.

OBJECTIVES:

The student will:

- provide at least one solution for at least one moral dilemma.
- suggest reasons for selecting a particular solution.

STUDENT TEXT:

(The first four items are for reading and discussion in class.)

Brenda and the Kitten

To Strike or Not To Strike

TB in the Boarding House

The Telltale Cell

Responding to Moral Dilemmas (optional homework assignment)

SUGGESTED TEACHING PROCEDURES:

[Read "Brenda and the Kitten."]

A. Responding to a Moral Dilemma: Ask the students to read "Brenda and the Kitten," in the Student Text. When they have finished the story they should jot down, on a separate sheet of paper, their answers to two questions: (1) What should Brenda do? (2) Why should she do that? Allow as much time as is necessary to complete this task. Discourage any discussion of the story until students have answered the two questions. Collect the papers.

B. Discussion of the Differences among Responses: Make two columns on the chalkboard, headed "Rescue the Kitten" and "Don't Rescue the Kitten." By a show of hands, determine how many students chose each of the possible solutions, and record the numbers in parentheses beside the headings. Before proceeding with the discussion, ask if anyone had another solution. (Since all solutions must result in a decision to rescue or not to rescue the kitten, a short discussion should enable all students to see that their responses can be so categorized.)

Now read aloud some of the reasons given, and record a brief summary of each reason in the appropriate column. These will take such forms as "Children should obey parents" and "Animals in distress deserve help." Spend some time reading responses and/or allowing students to suggest reasons for one or the other solution. As the columns acquire several reasons, the point should become clear: people respond differently to the same moral dilemma, often for very good reasons.

[Read "To Strike or Not To Strike", "TB in the Boarding House" and "The Tell-tale Cell."]

C. Discussion of Additional Moral Dilemmas: The Student Text includes three additional vignettes that present moral dilemmas, each more complicated than the first vignette. You may not want to discuss all of them, but if students are interested, the discussion will provide them with additional practice in analyzing reasons for responses. A thorough discussion of all three will probably require an additional class period to complete. Central questions that can be raised about each dilemma are:

1. What is the dilemma (or what alternative courses of action are possible)?

2. What values (or value principles) are involved?

3. How do they conflict?

4. Why select one value as opposed to another?

It isn't necessary to follow the more formal procedure of recording responses on paper and then reading them aloud. As students consider the three additional dilemmas, the discussion probably won't allow time for such careful recording. However, students should reach a point at which they can easily see that different responses are possible, and that these dilemmas are not easily resolved.

ASSIGNMENT:

[Read "Responding to Moral Dilemmas."]

The reading "Responding to Moral Dilemmas" may be assigned if you believe it will benefit your class; it is not essential, but will assist in the discussion of the required assignment: Students are to write a story that contains a moral dilemma in which the central character is faced with conflicting values. The students should also try their stories on two or more people, preferably persons of very different ages (i.e., very young siblings or neighbors, parents, etc.). Without telling their respondents what others have answered, students should be ready to report the responses they receive, and the reasons given.

Note: if you believe your students will be unwilling or unable to construct a story of their own, they can try the story about Brenda with several respondents. They may want to try one of the other vignettes in their text, but they should be encouraged to use "Brenda and the Kitten" because it will be more easily understood by very young children.

Students should be reminded (1) to interview at least two respondents and (2) to report responses and the reasons given for those responses.

LESSON 19: RESPONDING TO MORAL DILEMMAS

SYNOPSIS:

This lesson is a discussion of the assignment, including a comparison of the ways in which respondents of different ages reasoned through student-developed moral-dilemma vignettes.

OBJECTIVES:

The student will:

- write a vignette that contains a moral dilemma.
- interview two or more persons and report their responses and the reasons given for those responses to the student-written vignette.

STUDENT TEXT:

Responding to Moral Dilemmas (optional, for discussion in class)

The Development of Moral Reasoning (homework assignment)

SUGGESTED TEACHING PROCEDURES:

A. Discussion of Assignment: If students have written vignettes, some time should be spent in discussing the stories. Questions such as "What is the dilemma?" "What values are involved?" and "Why did you select the dilemma?" are all potential discussion items. If students did not complete their own stories, proceed to the next section.

B. Discussion of Responses: If students used "Brenda and the Kitten" with their respondents, this discussion will proceed more easily since all responses are to the same story. Proceed as you did in the previous lesson, listing responses and, under each column, short statements of the reasons given. This time you should also indicate the age of each person whose reason is reported.

If students used their own stories, it will be necessary to ask a few students to report their responses and the reasons given. In any event, students will want to spend some time discussing their experiences in interviewing respondents. Some time will be necessary for this, but you should focus on the reasons given for responses and, when some of these are displayed, any differences that may appear among responses when they are grouped according to age of the respondents.

C. Analyzing Reasons Given by Respondents: Enough reasons should appear through discussion to allow this comparison. Ask the class whether there appears to be any difference in the responses given by persons of different ages. You might ask them if they had expected this difference, and why (or why not). If students have read the optional assignment, they will know that three levels of response are possible, and they may be able to relate these to the reasons they received from thier own respondents. Otherwise, they will not be able to make such refined analyses, but they may be able to see that young children respond differently. With some cues from you, they may see the difference between responses that indicate a concern for self and those that indicate a concern for others. If time allows, raise the question of whether differences might also be attributed to culture. That it, would people in some cultures tend to respond at different levels than persons in other cultures? Why, or why not?

ASSIGNMENT:

[Read "The Development of Moral Reasoning."]

Students should read "The Development of Moral Reasoning," in the Student Text. This is an excellent time for a written assignment in preparation for the next discussion. Some topics you may wish to assign are listed on the following page.

1. Relate Kohlberg's theory of cognitive moral development to what you have learned of Piaget's theory of cognitive development. Do the two theories correspond? How?

2. Could you use the same methods to study moral development that Piaget used to study cognitive development? Explain your reasons.

3. Consider all that you have studied about human development in this unit. What conclusions can you draw? Support your answer with evidence gained both from readings and from the experiments and survey you have participated in.

LESSON 20: GENERALIZING ABOUT INTELLECTUAL DEVELOPMENT

SYNOPSIS:

This is the final lesson in this unit; it consists of a discussion of the homework assignment, leading to a more general consideration of the topic of cognitive growth.

OBJECTIVES:

The student will:

- state generalizations about intellectual growth and provide supporting evidence.
- provide examples that relate his knowledge of intellectual development to health-care situations.

SUGGESTED TEACHING PROCEDURES:

You should conduct a discussion according to your preferred techniques. If you gave a written assignment it can serve as a starting point. During the discussion, the following points should be introduced.

1. "Growth" or "development" can mean many things; "intellectual development," or "cognitive growth," refers to the development of new ways of approaching problem situations, whether they are moral problems or not. "Cognitive moral development" refers to the development of new ways of reasoning about moral dilemmas.

2. Intellectual development is not a closed area of investigation. There is considerable evidence to support Piagetian theory, but there is much less evidence to support Kohlberg. The theory of cognitive moral development is interesting, and it may be of use in understanding cognitive growth, but it is by no means proved.

3. An understanding of intellectual development is of use to health-care professionals in that it can help them relate with their clients.

4. In addition to these general points, the questions about Kohlberg contained in the reading assignment can be used in discussion. The two objectives of this lesson can also be accomplished through discussion of possible generalizations about intellectual development and its relationship to health-care matters.

SUPPLEMENTARY LESSON: ASSESSMENT OF DRUG STUDIES

SYNOPSIS:

This lesson is a class discussion that should be conducted shortly after Section 20 of Science Unit IV. (Because Unit IV of Social Science is much shorter than the corresponding Science unit, your students will still be studying Science Unit IV when you begin Unit V of Social Science.) Students have studied drugs in Science; this lesson raises some common shortcomings of experimental design, and is therefore appropriate for your class.

OBJECTIVES:

The student will:

- identify one or more criteria for evaluating the trustworthiness of drug studies and state why the criteria are important.
- distinguish between retrospective and other studies.
- describe the use of experimental and control groups in drug studies.

STUDENT TEXT:

Drug Studies (reading to be assigned the day before this lesson is taught)

SUGGESTED TEACHING PROCEDURES:

[Read "Drug Studies."]

Conduct the discussion according to your preferred style. The following discussion questions may be of use.

1. Why is it important that the subjects be a representative sample of a larger population? (If they aren't, then conclusions drawn about the subjects cannot be generalized to any larger group.)

2. Why is it important than the researcher identify the ingredients of the drug he is using and know the doses used by his subjects? (Otherwise he does not know what he is studying the effects of.)

3. Why are retrospective studies useful? (Because they give information about people who have been using drugs for a long time. The only other way to get that kind of information would be to give the drug to subjects for a long time, which in many cases would be illegal or too expensive, or would be too slow in providing needed information.)

4. If a retrospective study shows that most chronic users of a drug have a particular disease, does this finding prove that the drug causes the disease? Why or why not? (This finding might strengthen the hypothesis that there is some association between the drug and the disease, <u>if</u> the researchers have also shown that the subjects did not have the disease before they took the drug and <u>if</u> they have eliminated all other likely causes of the disease. But the findings of a retrospective study would not prove anything; proof would come only from clinical and laboratory studies on the details of the process by which the disease is caused.)

5. Why do the experimental group and the control group have to be matched for any characteristic that might affect the subjects' responses to the drug? (Otherwise the selection of the groups might cause a difference between the two groups which the experimenters could mistakenly attribute to the drug.)

ASSIGNMENT:

If you wish to do additional study of this topic, you may want to make an assignment. One possibility is to assign students to evaluate a specific drug study, using the guidelines contained in the reading assignment. Studies can be obtained from such journals as Science and Scientific American, government publications and technical journals. Your colleague in Biomedical Science may be able to assist you in obtaining drug studies for student evaluation. If several students evaluate the same study, the results of their work can be compared in a discussion that follows.